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are required in greater quantity when the vital activity is increased, hence our bees will need more water as breeding, storing, or other work is increased in the hive.

The second kind of food is known under the term carbo hydrates. It includes all the sugars and starch. As starch, when eaten, is changed under the influence of a ferment into sugar we may well consider it with the sugars. The carbo hydrates consist of oxygen, hydrogen, and carbon-the two former in proportion to form water. It is a matter of common observation that when the carbo hydrates enter largely into the food, the animal is apt to gain rapidly in fat. We are not sure that the sugars are changed directly into animal fat, possibly they serve so admirably as food, that they produce such an excellent condition of the animal system, that all the food is utilized, and a surplus is at hand which is stored up as fat. May be the nitrogenous food as well as the sugars aid in forming the fat of the body, in either case the food must be chemically changed in that wonderful laboratory the animal organism. The fact remains that much sugar in the food promotes the deposits of fat. We all know how the feeding of corn increases the fat and does not the fact that corn contains over 67 per cent. of starch, which when eaten and digested is all changed to sugar enforce the position here taken. Again when animals hibernate, or when they are long sick and take no food, the stored fat is used up. Thus if this stored fat can for a time serve the purpose of all food, it is not unreasonable to conclude that all organic food may under the best conditions be converted into fat. We positively know that animals may eat all muscle, as beef's heart and yet the liver will form glycogen, which in turn becomes liver sugar, and as we have seen in the marvelous economy of the body sugar promotes the formation of fat, it may be that all food under the best conditions conduces to the storing up of fat, and that sugar powerfully aids to bring about this most favorable condition. just These carbo hydrates are often styled the heat-producing foods. I think this term false and misleading. It is probable that all food, of which these sugars are an important part, are to nourish or to build up tissues and carry on the organic pro-This vital work generates heat. cesses. Heat then is incidental. Nutrition is to build up and keep the body in working condition ; in doing this the body is kept warm.

We have seen that stored fat in animals that hibernate, and in case of disease, will alone serve to keep up the nutrition. We have also seen that these carbo hydrates conduce more than other food to the formation of this fat. Is it not

scientific then to urge that the pure carbo hydrates are the best food on which to winter our bees? And this is enforced I believe by experience and by nature as well, for I doubt not but that in most cases in nature, almost the entire food of bees while they are quiescent in winter is honey.

Let me state further that cane sugar which composes from one to eight per cent. of honey when eaten by any animal, man included, is changed in the stomach to a sugar much like, if not identical with honey. The bees do the same with nearly all the cane sugar of nectar or with most of the cane sugar when they feed upon it. Hence it is more than likely that honey is one of the most healthy and nutritious of all our sugars, that the bees have done for us what we would have to do for ourselves had we eaten the cane sugar. Who has not found that honey seems to go further, and satisfy more quickly, even than cane sugar when eaten on our tables. One more point, common glucose, or grape sugar-I now mean the artificial product produced by the action of sulphuric acid on corn starch-honey, and liver sugar are usually all called glucose or grape sugar by chemists. They are chemically identical and give the same reactions with the copper salts which they all reduce, which fact furnishes one of the best tests for these sugars. Yet I do not believe they are the same. Physiologically they seem quite different. Why when we eat glucose is it changed to glycogen in the liver and then to liver sugar, unless the latter is more easily assimilated ? Why do bees thrive on honey and die when fed the artificial glucose? Why do bees refuse to eat artificial grape sugar when honey or nectar is to be had? All these facts seem to indicate what I believe to be true. that physiologically honey, starch glucose and liver glucose are really different. Taste and vital action are nicer chemists than our scientists. and detect differences which the latter as yet fail to recognize. It is possible that honey and liver glucose are identical. The fact that both arise in the animal body under the influence of the digestive ferments would make this view plausible.

The third group of food elements consists of the fats. The higher animals obtain these largely in all vegetable and animal food. While the fats, also called by some the hydro carbons, consist of the same chemical elements as do the carbo hydrates, the oxygen is far less in amount. Actual experiment has shown that higher animals thrive poorly without some of this kind of food. Its value is farther attested by the appetite which craves fat, especially if the weather is cold. Bees get some of this kind of food in their pollen. It seems quite likely that the stored fat of the body